SOLID STATE STEREO AMPLIFIER, Type TSA8

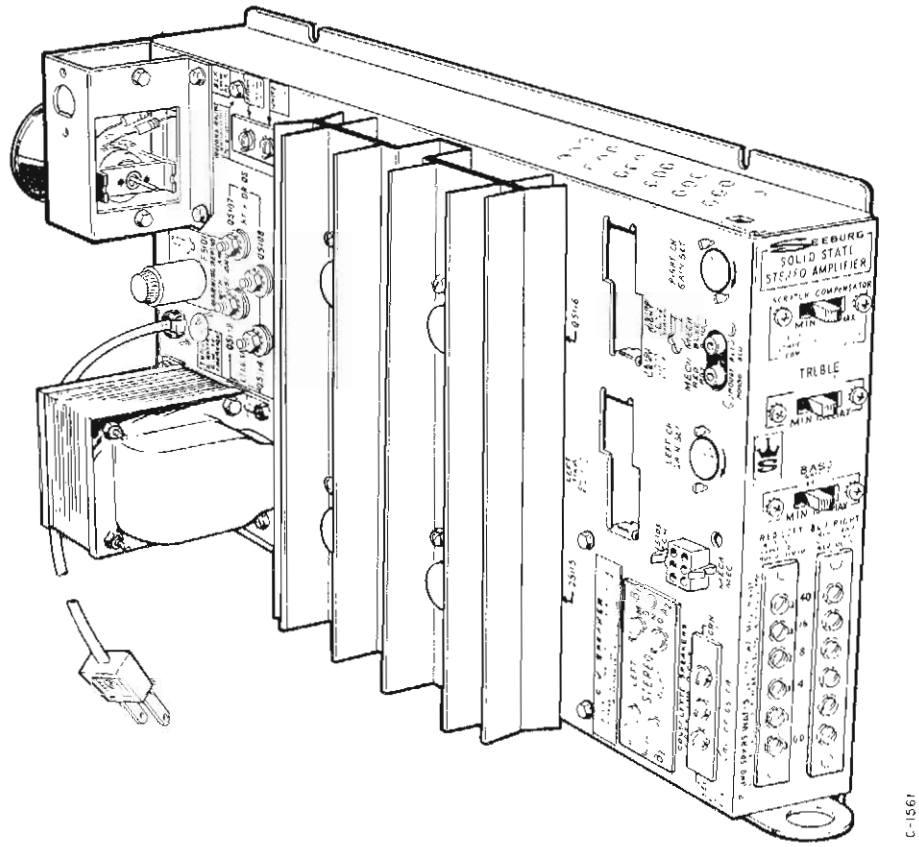


Figure 1. Solid State Stereo Amplifier, Type TSA8.

1. GENERAL

The Solid State Stereo Amplifier, Type TSA8 is a fully transistorized, dual channel, low distortion, high fidelity amplifier with a power output of 40 watts per channel. A special feature of this amplifier is the speaker overload protection circuit. This circuit continually monitors the output current. If the output current increases to a level that may damage the amplifier, the speaker overload protection circuit reduces collector voltage on the first stage of the preamplifiers to practically 0 volts, thereby cutting off signal to the power stages of the amplifier.

The amplifier also contains circuits for treble, bass and record scratch compensation. These controls enable the output to be varied to fit the customer's need.

2. CIRCUIT DESCRIPTION

For the purpose of discussion, the audio signal will be traced only through the right channel. (Refer to Schematic Diagram).

a. Preamplifier

The preamplifier circuit consists of four transistor stages, Q5101, Q5102, Q5103 and Q5104. Transistors Q5101 and Q5102 are part of a preamplifier with an equalization network that provides RIAA record compensation. Audio signals from the pickup cartridge are coupled to the base of Q5101 where they are amplified and coupled to the base of Q5102. Part of the output of Q5102 is fed back to the emitter of Q5101.

A low frequency coupling network L5101 and R5102 is connected from the collector of Q5102

to the collector of a similar circuit in the left channel. Undesirable low frequency signals are then coupled in an out of phase condition effectively cancelling them out.

The remaining output from Q5102 is capacitively coupled to the base of Q5103. Transistors Q5103 and Q5104 are connected in a "Darlington" configuration which is characterized by a high input impedance and a low output impedance. The output of Q5104 is then coupled to the AVC circuit, the TREBLE, BASS and VOLUME controls and the predriver.

b. AVC Circuit

A sampling of the output of Q5104 is coupled through C5105 to the base of Q5105. The output from the collector of Q5105 is rectified by diode CR5106 creating a d.c. voltage. This voltage varies with the average amplitude of the signal voltage applied to Q5105. This varying d.c. voltage is directly coupled to the junction of diodes CR5106 and CR5107. If a large signal voltage is coupled to Q5105, then a large d.c. signal is coupled to diodes CR5106 and CR5104. This large signal forward biases the diodes effectively decreasing their resistance. As the resistance decreases, more of the signal voltage at the base of Q5103 is shunted to ground effectively decreasing the input signal to Q5103.

c. Treble, Bass, Volume and Gain Set Controls

The TREBLE and BASS controls are in parallel with the output from Q5104. The TREBLE control varies the amount of high frequencies fed through the VOLUME control to the predriver stage, Q5106. The BASS control varies the amount of low frequencies fed to Q5106. The VOLUME control varies the amount of drive to the base of Q5106. The individual Gain Set Controls compensate for gain differences of the voltage amplifier and/or power amplifier. It is also used to balance the system.

d. Predriver, Driver and Power Amplifier Stages

The output from the VOLUME control is capacitively coupled to the base of predriver stage Q5106. The output of Q5106 feeds the bases of driver stages Q5107 and Q5108. Power amplifier stages Q5109 and Q5110 are operated in a complimentary symmetry configuration which produces the power required to drive the output transformer, T5102.

e. Short Circuit Protection Circuit

This circuit prevents amplifier damage due to short circuits, overloads or incorrect connections in the speaker system. If a condition occurs in the speaker system that may result in damage to the amplifier, the short circuit protection circuit biases the input transistors into cut-off.

Refer to Schematic Diagram. The output current is monitored by measuring the voltage across emitter resistor R5128. As the current through R5128 increases, capacitor C5122 charges in the polarity shown. For any particular time period the potential reached is only a fraction of the potential at the emitter resistor due to the time constant determined by DELAY TIME potentiometer R5143A and the voltage divider consisting of R5136 and R5137. If the current through R5128 increases enough, capacitor C5122 will charge to a potential that results in the conduction of Q5111. When Q5111 conducts its collector current forward biases Q5112 causing Q5112 to conduct. Due to feedback between the transistors, both Q5111 and Q5112 saturate and become independent of C5122.

When Q5112 saturates, the potential on the collector rises from −20 volts to near zero. This change in potential is coupled through R5130 to the forward bias CR5102, thereby reducing the collector voltage of Q5101 in the Preamplifier to practically zero. This cuts off the first stage of the Preamplifier preventing any further signal from passing through the amplifier. Since the power amplifier stages are operating near class B, no input results in very little current flow.

f. Mute Relay

The mute relay (K5101) is used to quiet the amplifier before record transfer takes place to avoid unpleasant noise in the output. The relay is energized whenever the trip switch in the Select-O-Matic Mechanism is closed. A holding circuit for the mute relay is completed through contacts 3M11 of the cam switch in the mechanism. These contacts are closed when the mechanism is in the transfer or scan position.

When the mute relay is energized, contacts 1A11 close completing a circuit to the trip solenoid in the mechanism. Contacts 1A1 and 1A21 close to mute the amplifier. Contacts

1A1 ground the audio signal from the top of the right channel volume control. Contacts 1A21 ground the audio signal from the top of the left channel volume control.

When contacts 1A12 open, the ground circuit to diodes CR5108 and CR5109 is opened. This allows capacitors C5120 and C5121 to charge in the direction indicated which results in diodes CR5104, CR5105, CR5106 and CR5107 being forward biased. Forward biasing diodes CR5104, CR5105, CR5106 and CR5107 grounds the input signal to the base of the amplifier stage (Q5103) through C5103. When the mute relay is de-energized and contacts 1A12 close, capacitor C5121 discharges slowly through R5132. This results in a slow unmuting of the amplifier rather than a sharp return to music.

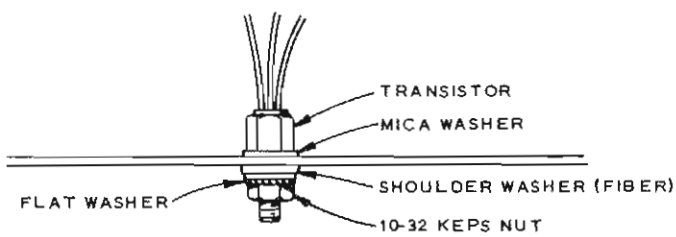
3. ADJUSTMENTS AND MAINTENANCE

a. Driver Transistor Replacement

If the driver transistors, Q5107, Q5108, Q5113 or Q5114 need to be replaced, they must be mounted as shown in Figure 2. Be sure both sides of the mica washer are coated with silicone grease.

NOTE:
APPLY SILICONE GREASE TO CLOTH SIDES OF MICA WASHER BEFORE REPLACING CHASSIS.

Figure 2.



b. Bias Adjustment for Output Transistors

The bias adjustment potentiometer located in the corner of each voltage amplifier printed circuit board is used to properly adjust bias on the output transistors. This adjustment should not be touched unless components in the Pre-driver, Driver or Output Stages are changed. For proper adjustment of bias see Note No. 9 on the schematic diagram.

c. Speaker Overload Circuit Adjustment

The speaker overload protection circuit can be adjusted as follows:

1. Connect signal generator to amplifier as described in Note 1 on schematic diagram (for this adjustment a 560 ohm resistor can be used in lieu of a pickup cartridge).
2. Connect a 5 ohm, 20 watt, 5% resistor across output of each channel (40 watt tap to ground) as a dummy load.
3. Set controls as follows:

   Volume Control - Maximum
   Treble - Maximum
   Bass - Maximum
   Scratch Compensator - Minimum
   Line Voltage - 120 VAC

4. Using a jumper wire short, out the AVC capacitor C5121 (100 mfd., 12 V. Lytic).
5. Set signal generator on 1000 Hertz and adjust level control for 1.7 millivolts at the input to each channel of the amplifier (use Simpson type 715 meter or its equivalent).
6. Adjust Gain Set Pots (R5112 and R5144) in each channel for 3.5 V ± 1 V output voltage across each 5 ohm dummy load.
7. Remove short from AVC capacitor (C5121).
8. Adjust signal generator level control for 6 millivolt input to amplifier at 1000 Hertz.
9. Adjust amplifier volume control for 4.8 volt output voltage across each 5 ohm dummy load.
10. Short AVC capacitor (C5121).
11. Energize Mute Trip Relay for a minimum of 5 seconds by grounding the WHITE terminal of the PRVC terminal strip TB5105.
12. Adjust signal generator for 15 millivolt input to amplifier at 2000 Hertz.

CAUTION: Do not leave 15 mv signal on input to Amplifier for more than 5 seconds with Mute Trip Relay de-energized.

13. De-energize Mute Trip Relay. The speaker overload protection circuit should be activated in 1.5 to 2.0 seconds from the time the Mute Trip Relay is de-energized. Adjust (R5143) Speaker Overload Timing Pot for the above mentioned time.

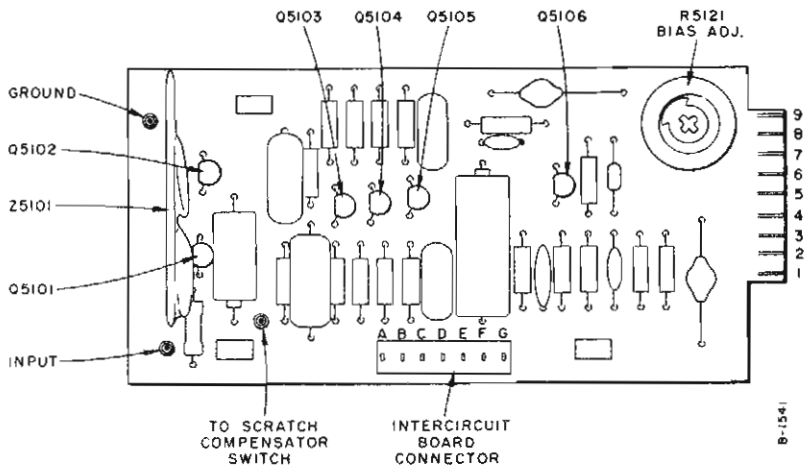


Figure 3. Voltage Amplifier Control Circuit Board.

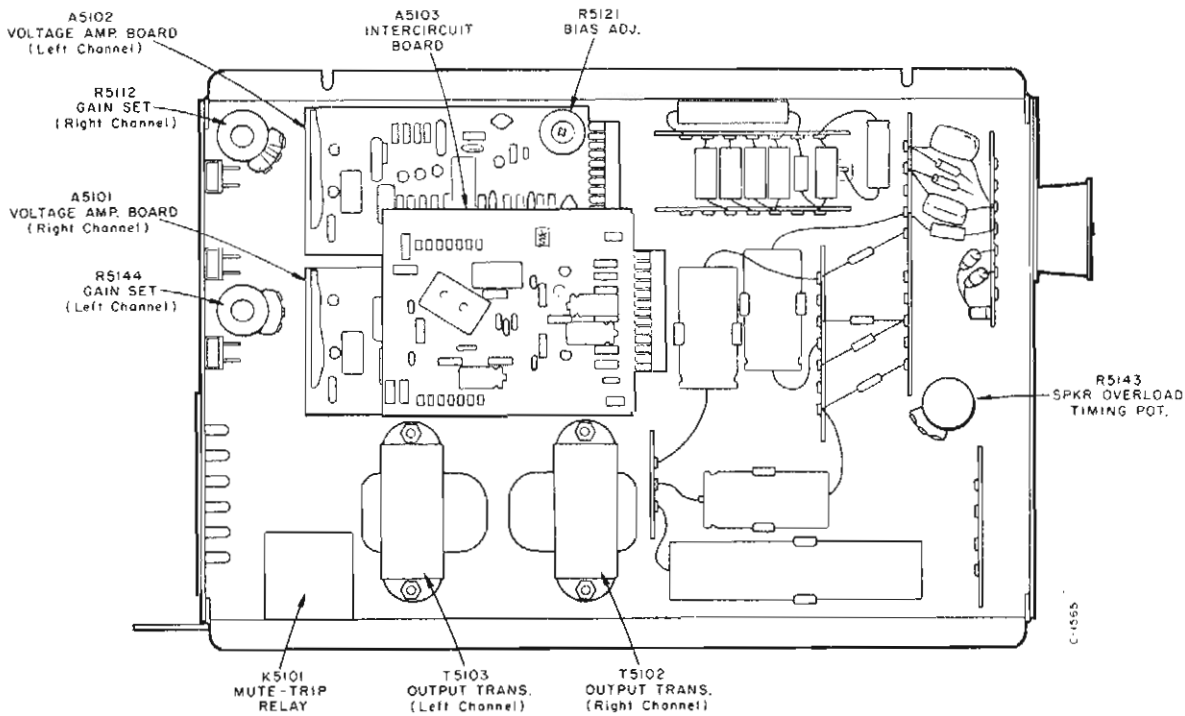
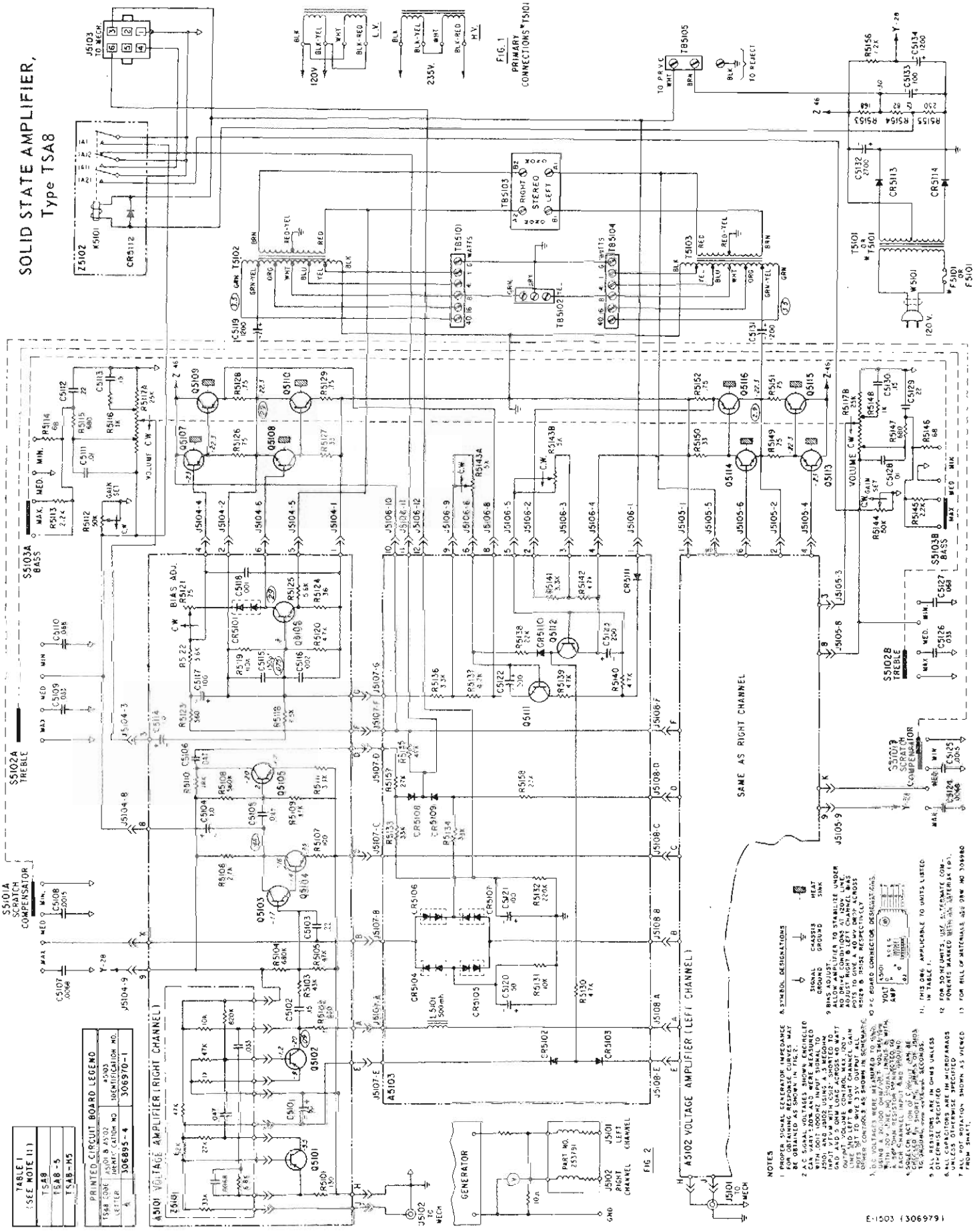


Figure 4. Parts Location Detail - Bottom View.


SOLID STATE AMPLIFIER,
Type TSA8
A5101 VOLTAGE AMPLIFIER (RIGHT CHANNEL)
A5102 VOLTAGE AMPLIFIER (LEFT CHANNEL)
SAME AS RIGHT CHANNEL
S5101A SCRATCH COMPENSATOR
S5102A TREBLE
S5103A BASS
S5103B SCRATCH COMPENSATOR
S5102B TREBLE
S5101B BASS
CW BIAS ADJ.
VOLUME CW
GAIN SET
MIN.
MED.
MAX.
TO PRVC
TO REJECT
120V
235V.
L.V.
H.V.
FIG. 1 PRIMARY CONNECTIONS *T5101
FIG 2
GENERATOR
TO MECH.
TO PRVC
STEREO
MONO
RIGHT
LEFT
120 V.
NOTES
TABLE I (SEE NOTE 11)
TSA8
TSA8-S
TSA8-MS
PRINTED CIRCUIT BOARD LEGEND
TSA8 CODE
LETTER
IDENTIFICATION NO.
306895-4
306970-1

PARTS LIST FOR SOLID STATE AMPLIFIER, Type TSA8

Item	Part No.	Description
A5101	306895	Voltage Amplifier Board Assem.
A5102	306895	Voltage Amplifier Board Assem.
A5103	306970	Intercircuit Board Assembly
C5101	87703	50, 12 V., Lytic
C5102	86303	.15, 50 V., Mylar
C5103	86331	.22, 50 V., Mylar
C5104	87754	1.0, 35 V., Tantalum
C5105	86327	.047, 50 V., Mylar
C5106	86327	.047, 50 V., Mylar
C5107	86332	.0068, 50 V., Mylar
C5108	86240	.0015, 500 V., Ceramic
C5109	86336	.033, 50 V., Mylar
C5110	86351	.068, 50 V., Mylar
C5111	86313	.01, 500 V., Ceramic
C5112	86331	.22, 50 V., Mylar
C5113	86303	.15, 50 V., Mylar
C5114	87754	1.0, 35 V., Tantalum
C5115	86243	150 PFD, 500 V., Ceramic
C5116	86255	.002, 500 V., Ceramic
C5117	87700	100, 35 V., Lytic
C5118	86309	.001, 500 V. Ceramic
C5119	87726	1200, 35 V., Lytic
C5120	87696	50, 6 V., Lytic
C5121	87724	100, 12 V., Lytic
C5122	87744	200, 6 V., Lytic
C5123	87744	200, 6 V., Lytic
C5124	86332	.0068, 50 V., Mylar
C5125	86240	.0015, 500 V., Ceramic
C5126	86336	.033, 50 V , Mylar
C5127	86351	.068, 50 V , Mylar
C5128	86313	.01, 500 V., Ceramic
C5129	86331	.22, 50 V. Mylar
C5130	86303	15, 50 V., Mylar
C5131	87726	1200, 35 V., Lytic
C5132	87748	2700, 50 V., Lytic
C5133	87700	100, 35 V , Lytic
C5134	87726	1200, 35 V . Lytic

Item	Part No.	Description
CR5101	309478	Silicon Stabistor
CR5102	309481	Silicon Diode, 40 PIV
CR5103	309481	Silicon Diode, 40 PIV
CR5104, CR5105, CR5106, CR5107	309463	Silicon Stabistor
CR5108	309481	Silicon Diode, 40 PIV
CR5109	309481	Silicon Diode, 40 PIV
CR5110	309373	Silicon Rectifier, 100 PIV
CR5111	309373	Silicon Rectifier, 100 PIV
CR5112	309384	Silicon Diode, 170 PIV (Pt. of Z5102)
CR5113	309477	Silicon Rectifier, 200 PIV
CR5114	309477	Silicon Rectifier, 200 PIV
P5101	306316	8/10 Amp., Slo Blo
*P5101	306369	5/10 Amp., Slo Blo (–H5 Models)
J5101	306916	Input Socket
J5102	306916	Input Socket
J5103	309355	Part of Cable Assembly
J5104	309307	9 Position Edge Connector
J5105	309307	9 Position Edge Connector
J5106	309308	12 Position Edge Connector
J5107	941851	Part of P.C. Board Assem.
J5108	941851	Part of P.C Board Assem.
K5101	306914	Mute Trip Relay (Pt. of Z5102)
L5101	306792	500 MH Inductor
Q5101, Q5102, Q5103, Q5104, Q5105	309436	PNP
Q5106	309437	PNP
Q5107	309429	PNP

Item	Part No.	Description
Q5108	309430	NPN
Q5109	309412	PNP Power
Q5110	309412	PNP Power
Q5111	309434	NPN
Q5112	309435	PNP
Q5113	309429	PNP
Q5114	309430	NPN
Q5115	309412	PNP Power
Q5116	309412	PNP Power

NOTE: 1. Unless otherwise specified all resistors are in ohms, ½ watt and 10%.

2. Unless otherwise specified all capacitors are in microfarads

3. For 50 Hz. units, use alternate components marked with an asterisk (*).

PARTS LIST FOR SOLID STATE AMPLIFIER, Type TSA8

Item	Part No.	Description
R5101	82655	130, 5%
R5102	82423	820
R5103	82678	43 K, 5%
R5104	82458	680 K
R5105	82676	47 K, 5%
R5106	82429	2,700
R5107	82618	100, 5%
R5108	82457	560 K
R5109	82444	47 K
R5110	82439	18 K
R5111	82624	3,300, 5%
R5112	306319	50 K, Pot.
R5113	82428	2,200
R5114	82410	68
R5115	82422	680
R5116	82424	1K
R5117A, R5117B	306318	25 K, Pot.
R5118	82631	7,500, 5%
R5119	82779	110 K, 5%
R5120	82627	4,700, 5%
R5121	306915	75 Pot.
R5122	82629	5,600, 5%
R5123	82421	560
R5124	82993	36, 5%
R5125	82433	5,600
R5126	82649	75, 5%
R5127	82406	33
R5128	81284	0.75, W.W., 5 W., 5%
R5129	81284	0.75, W.W., 5 W., 5%
R5130	82432	4,700
R5131	82436	10 K
R5132	82452	220 K
R5133	82442	33 K
R5134	82442	33 K
R5135	82444	47 K
R5136	82430	3,300
R5137	82432	4,700
R5138	82440	22 K
R5139	82432	4,700
R5140	82432	4,700
R5141	82430	3,300
R5142	82432	4,700
R5143A, R5143B	306804	5 K, Pot.
R5144	306319	50 K, Pot.
R5145	82428	2,200
R5146	82410	68
R5147	82422	680
R5148	82424	1 K
R5149	82649	75, 5%
R5150	82406	33
R5151	81284	0.75, W.W., 5 W., 5%
R5152	81284	0.75, W.W., 5 W., 5%
R5153	81243	168, W.W., 10 W.
R5154	81237	82, W.W., 2 W.
R5155	81201	250, W.W., 5 W.
R5156	81282	1,200, W.W., 2 W.
R5157	82441	27 K
R5158	82441	27 K

Item	Part No.	Description
S5101A, S5101B	306329	Scratch Compensator
S5102A, S5102B	306329	Treble
S5103A, S5103B	306329	Bass

Item	Part No.	Description
T5101	306953	Power Transformer (120 V., 60 Hz.)
*T5101	306954	Power Transformer (-5 & -H5 Models)
T5102, T5103	306948	Output Transformer
TB5101	306304	6 Lug Terminal Board
TB5102	305831	3 Lug Terminal Board
TB5103	306338	4 Lug Terminal Board
TB5104	306304	6 Lug Terminal Board
TB5105	307650	2 Lug Terminal Board
W5101	766369	Line Cord & Plug Assembly
Z5101	306900	Pre-Amp Network (Alt 306930)
Z5101	306930	Pre-Amp Network (Alt 306900)
Z5102	306914	Mute Trip Relay Assembly

NOTE: 1. Unless otherwise specified all resistors are in ohms, ½ watt and 10%.

2. Unless otherwise specified all capacitors are in microfarads.

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